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New concept for bean leaf beetle management

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Abstract
Bean leaf beetles feeding on soybean pods can lead to significant reductions in seed quality and yield throughout Iowa. Management of bean leaf beetles in soybeans during the pod setting and filling stages can be frustrating for farmers and crop advisers because beetles may feed on pods for a couple of weeks before the population reaches the economic threshold. In this situation, some loss in seed quality and quantity occurs before an insecticide application can be economically justified. Is there any way to realistically prevent this economic damage?

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Bean leaf beetles feeding on soybean pods can lead to significant reductions in seed quality and yield throughout Iowa. Management of bean leaf beetles in soybeans during the pod setting and filling stages can be frustrating for farmers and crop advisers because beetles may feed on pods for a couple of weeks before the population reaches the economic threshold. In this situation, some loss in seed quality and quantity occurs before an insecticide application can be economically justified. Is there any way to realistically prevent this economic damage?

The bean leaf beetle often has four rectangular spots in the center of the wing covers.

Enlarge [1]

During the past 15 years, entomologists at Iowa State University have been researching the biology and behavior of the bean leaf beetle in soybean. We now have sufficient research-based information to make a management decision for second-generation bean leaf beetles based upon the population size of the first generation. This article explains this new management concept.

Bean leaf beetle adults overwinter in Iowa. The survival of the beetles through winter is highly affected by the low winter temperatures. A relatively large number of beetles was estimated to survive through the recent warm winter of 1999-2000. High infestation of the overwintered beetles on soybean was observed during this spring, especially in early planted soybean fields.

The beetle has two generations a year in Iowa. It is actually the second-generation beetles, which emerged from the soil to feed on pods last fall and then spent the winter in hibernation, that attack seedling soybeans in the spring. The females of this generation lay eggs in the soil that then develop into first-generation beetles that emerge in late June and July. These first-generation adult populations usually peak in the late vegetative or the early reproductive soybean stages, whereas the second-generation adults peak during the pod-fill stage. The feeding by first-generation beetles on soybean leaves seldom results in economic yield losses, but the second-generation feeding on pods in late summer can be very significant.

A degree-day model was developed to estimate the occurrence of first-generation adults in the field. The degree days for the first-generation adults were estimated to be 1212 degree days with a developmental threshold at 46°F. The overwintered female beetles usually begin

to lay their eggs after colonizing the bean fields. The degree-day estimation for the first-generation adults is calculated by accumulating the temperature at the week of soybean emergence. Table 1 shows the accumulated degree-days for the first-generation adults from May 1 through June 28 in five different areas of Iowa. Table 2 shows the dates predicted for the peak emergence of first-generation adults at these locations.

The new management concept is to sample the first-generation beetles and then to use this information to manage the second-generation beetles. This is how it works:

1. Determine what week your soybeans emerged from the soil.
2. Consult Table 2 (left-hand column) and find the dates that match your soybean emergence date.
3. Determine which of the five Iowa locations is closest to your field.
4. Where the date (row) and location (column) intersect, this is the predicted date for peak first-generation beetle emergence.
5. Sample your soybean fields 1 week after the predicted peak emergence. If the number of beetles reaches or exceeds the threshold (Table 3 or 4), stop sampling. If the sample is below the threshold, sample the following week. If the sample remains below the threshold, sample a third and final week. If the threshold is not reached, then an economic infestation of bean leaf beetles should not occur in your pod-stage soybeans.
6. If the first-generation population is above the threshold, then scout the fields again in late August to monitor for the first emerging beetles of the second generation. When the first beetles appear, spray the field with an insecticide (45-day preharvest interval or less). Based upon the population size of the first generation, it is expected that the second generation will exceed the economic threshold.

Fields can be sampled for first-generation beetles by using either a drop cloth or a sweep net. Here are the procedures for each method.

Drop cloth

- Walk 100 feet in from the field edge and scout each field and each variety separately.
- Place a 3-foot wide strip of cloth on ground between the rows.
- Bend the plants on one row over the cloth, and shake them vigorously.
- Count the number of beetles on the cloth.
- Repeat the procedure four times for each 20 acres of the field.
- Determine the average number of beetles per 3-foot of row.
- Consult Table 3 for the number of beetles per 3-foot of row necessary to justify insecticide treatment for the second-generation adults in August or September.
- If the number of beetles is below the economic threshold, sample your fields again the following week, or a third week if necessary.

Sweep net

- Walk 100 feet in from the field edge and scout each field and each variety separately.
- Take 20 sweeps.
- Repeat the procedure four times for each 20 acres of the field.
- Determine the average number of beetles per 20 sweeps.
- Table 4 shows the number of beetles per 20 sweeps that justifies insecticide treatment for the second-generation adults.

- If the number of beetles is below the economic threshold, sample your fields again on following week, or a third week if necessary.

In an upcoming article, we will discuss insecticide options for management of bean leaf beetles in pod-stage soybean.

See also the clarification [2] of this article in the July 24 issue.

Table 1. Degree-day accumulations for first generation bean leaf beetle adults (1212 degree-days with developmental threshold of 46°F) from the date of soybean emergence through June 28, 2000.

	Degree-Day Accumulations				
Date of Soybean Emergence	Decorah (Northeast)	Burlington (Southeast)	Des Moines (Central)	Omaha (Southwest)	Spencer (Northwest)
May 1-7	1039	1221	1240	1308	1158
May 8-14	884	1075	1088	1158	1002
May 15-21	788	960	980	1044	911
May 22-28	708	850	859	918	823

Table 2. Predicted dates for peak emergence of first-generation bean leaf beetle adults.

	Degree-Day Accumulations				
Date of Soybean Emergence	Decorah (Northeast)	Burlington (Southeast)	Des Moines (Central)	Omaha (Southwest)	Spencer (Northwest)
May 1-7	July 7	June 28	June 27	June 24	July 1
May 8-14	July 15	July 5	July 4	July 1	July 7
May 15-21	July 20	July 10	July 9	July 6	July 11
May 22-28	July 24	July 15	July 14	July 11	July 15

Table 3. Economic thresholds for first-generation bean leaf beetles (average number of

beetles per 3-foot of row).

	Management Cost ($/acre)								
$/bu	7	8	9	10	11	12	13	14	15
15	2.0	2.2	2.5	2.8	3.0	3.3	3.5	3.8	4.1
14	2.1	2.4	2.7	2.9	3.2	3.5	3.8	4.1	4.3
13	2.3	2.6	2.9	3.2	3.5	3.8	4.1	4.3	4.6
12	2.4	2.8	3.1	3.4	3.7	4.1	4.4	4.7	5.0
11	2.6	3.0	3.3	3.7	4.1	4.4	4.8	5.1	5.5
10	2.9	3.3	3.7	4.1	4.4	4.8	5.2	5.6	6.0
9	3.2	3.6	4.1	4.5	4.9	5.3	5.8	6.2	6.6
8	3.6	4.1	4.5	5.0	5.5	6.0	6.5	7.0	7.5
7	4.1	4.6	5.2	5.7	6.3	6.8	7.4	7.9	8.5
6	4.7	5.3	6.0	6.6	7.3	7.9	8.6	9.2	9.9
5	5.6	6.4	7.2	7.9	8.7	9.5	10.3	11.1	11.8
4	7.0	7.9	8.9	9.9	10.9	11.8	12.8	13.8	14.8

Table 4. Economic thresholds for first-generation bean leaf beetles (average number of beetles per 20 sweeps).

	Management Cost ($/acre)								
$/bu	7	8	9	10	11	12	13	14	15
15	8.1	9.2	10.2	11.3	12.4	13.4	14.5	15.6	16.6
14	8.6	9.8	10.9	12.1	13.2	14.3	15.5	16.6	17.8
13	9.2	10.5	11.7	12.9	14.2	15.4	16.6	17.9	19.1
12	10.0	11.3	12.6	14.0	15.3	16.6	18.0	19.3	20.6
11	10.8	12.3	13.7	15.2	16.6	18.1	19.5	21.0	22.4
10	11.8	13.4	15.0	16.6	18.2	19.8	21.4	23.0	24.6
9	13.1	14.8	16.6	18.4	20.2	22.0	23.7	25.5	27.3

8	14.6	16.6	18.6	20.6	22.6	24.6	26.6	28.6	30.6
7	16.6	18.9	21.2	23.5	25.8	28.1	30.3	32.6	34.9
6	19.3	22.0	24.6	27.3	30.0	32.6	35.3	38.0	40.6
5	23.0	26.2	29.4	32.6	35.8	39.0	42.2	45.4	48.6
4	28.6	32.6	36.6	40.6	44.6	48.6	52.6	56.6	60.6

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